VI. Occultations of Stars observed at Ashurst. By R. Snow, Esq.

1845.			h	m	s
Oct. 20.	ϵ^2 Orionis.	Sidereal time of immersion...	23	9	30±
...	...	... emersion ...	0	1	27·3
Dec. 6.	λ Piscium.	... immersion...	3	27	55·7
...	...	... emersion ...	4	13	35·5

West longitude $0^h\ 1^m\ 10^s$.
North latitude $51°\ 15'\ 55''$.

VII. On the Periods of the Satellites of *Saturn*. By S. M. Drach, Esq.

The author has extracted the periods and daily motions of the satellites of *Saturn* from Maëdler's Astronomy, in confirmation of the curious law announced by Sir J. Herschel in communication No. IX. of the Society's *Notice* for Dec. 1845. He observes that perturbations of the fifth order must often occur, and, in conclusion, proposes the following question:—"Has the action of the ring caused the *exact* duplication of periods not to take place? and has the absence of this appendage, in the case of *Jupiter*, allowed the absolutely rigorous formula $n_1 - 3\,n_2 + 2\,n_3 = 0$ to exist?"

VIII. On the Reduction of the Sextant Observations of the Distance of the Great Comet of 1843 from bright Stars. By the Rev. R. Main, one of the Secretaries of the Society.

In the introduction to this paper the author drew the attention of the meeting to the remarkable zeal with which cometary observations and calculations had been pursued during the last few years, both in this country and on the continent. In proof of this, he stated that the fifth and sixth volumes of the Society's *Monthly Notices* (commencing with the year 1840) contain announcements of the discovery of 13 comets, and that the number of communications received by the Society respecting them amounted to 140. The greater number of these comets were telescopic; but there were three (viz. the Great Comet of 1843, that of 1844–5, and the second Great Comet of 1845) which were visible to the naked eye, and therefore capable of being observed with instruments of the smallest optical power. A considerable number of sextant observations of each of these comets had been communicated, but especially of the comet of 1843, made chiefly by naval officers well accustomed to the use of that instrument. The number of these observations was so great, that it was deemed proper by the Council, in the beginning of the year 1844, to appoint a committee to provide for their discussion and reduction; and the author, in conjunction with Mr. Galloway and Mr. Stratford, undertook this responsibility. The task of performing the computations was given to Mr. Harris, the late Assistant Secretary; and the author took upon himself the preparation of the necessary

formulæ and the arrangement of the steps of the calculations. The author took occasion, in this part of the paper, to point out to the meeting how satisfactorily Mr. Harris had performed the work entrusted to him, the errors detected in a minute examination of it being far fewer than might reasonably be expected in a mass of work of so laborious and troublesome a character. Mr. Main then proceeded to give an account of the observations which had been reduced, and an explanation of the different steps of the processes employed. With very few exceptions, the observations are contained in the fifth and sixth volumes of the *Monthly Notices*, and the total number of results deduced from them was 199; and in a table is given the page of the volume at which the observations under discussion are to be found, together with the place and circumstances of observation, &c. Mr. Main then proceeded to mention in detail the principal processes of the calculation. The principal step that needs mention here is the formula which has been employed for correcting the observed distance from the effects of refraction and parallax. It was shewn by a mathematical investigation, that if Z and z be the zenith distances of the comet and one of the stars of comparison, and the vertical refractions be $\alpha_c \tan Z$ and $\alpha_s \tan z$; if, also, Π be the horizontal parallax of the comet, and d the distance of the comet from the star, then the whole correction of the distance will be,

$$(\alpha_c - \Pi \cos Z) \cdot \left(\frac{\cos z}{\cos Z} - \cos d\right) + \alpha_s \left(\frac{\cos Z}{\cos z} - \cos d\right).$$

After the computation of the approximate zenith distances of the comet and stars, this formula was found to be of very easy application. It was also explained how the values of the barometer and thermometer readings used in the work had been conjecturally supplied in cases (the greater number were such) where they had not been given by the author.

With respect to the deduction of the R. A. and N. P. D. of the comet from the corrected distances, the author first gave the following theoretical solution, which, though of no direct practical utility, may be interesting to the mathematician.

Let Δ, Δ', and σ be the N. P. D.'s and distance of the stars of comparison; π the N.P.D. of the comet; d and d' the observed corrected distances; then,

$$\left.\begin{array}{r}\sin^2\Delta \sin^2 d' \\ +\sin^2\Delta' \sin^2 d \\ +\sin^2\sigma \sin^2\pi\end{array}\right\} + 2\left\{\begin{array}{l}\cos\Delta\cos\pi(\cos d - \cos d'\cos\sigma) \\ +\cos\Delta'\cos\pi(\cos d' - \cos d\cos\sigma) \\ +\cos d\cos d'(\cos\sigma - \cos\Delta\cos\Delta') \\ +\cos\Delta\cos\Delta'\cos\sigma\end{array}\right\} = 2$$

Again, if the difference of R. A. of the star whose N. P. D. $= \Delta$ and the comet be x, and the angle at the comet subtended by that star and the pole be x'; α the difference of the R. A.'s of the stars, and β the angle subtended by them at the comet; then,

$$\frac{\cot x' - \cot\beta}{\cot x - \cot\alpha} = \frac{\sin\Delta' \sin\alpha}{\sin d \sin\beta}$$

and

$$\frac{1+\cot^2 x}{1+\cot^2 x'} = \frac{\sin^2\Delta}{\sin^2 d}$$

from which two equations cot x' may be eliminated, and a quadratic equation will result for the determination of x.

The author then proceeded to explain the practical rules which had been given for the solution of the spherical triangles requisite to determine the R. A. and N. P. D. of the comet.

In conclusion he animadverted upon several imperfections in the observations which had been discussed, and particularly on the want of sufficient explanation of several circumstances materially affecting their accuracy.

IX. Extract of a Letter from C. Piazzi Smyth, Esq., to the President, Dec. 1845, accompanying some drawings of the Great Comet of 1843.

The drawings in question are in Indian ink, and comprise five naked-eye views of the Great Comet on the nights of March 3d, 4th, 9th, 18th, and 25th; and six telescopic views of its head on the nights of March 3d, 4th, 6th, 9th, 22d, and 31st.

The former are 6·4 by 5 inches, containing 57° of altitude and 45° of azimuth; the latter are in circular spaces, 0°·5 in diameter, on a scale of 2·7 inches to 1°.

The writer remarks on the extensive and regularly progressive character of the changes of the comet's appearance in both series of drawings, and especially (as being directly contrary to the general opinion) on the concavity of the tail to the direction in which the body was proceeding; its angular advance on the line passing through the sun and the nucleus; and its continual increase in length: all the observations being subsequent to the perihelion passage.

He remarks also on the manner in which the principal phenomena seem to be accounted for by Sir John Herschel's mathematical theory (published in the sixth volume of the *Memoirs*); the very simple nature, or rather the reasonableness of that theory; the impossibility of refusing the little that is assumed in it; and the important characteristic which it has now acquired of being a true theory, inasmuch as, being framed to suit one class of comets, viz. round telescopic ones, it is found, without any addition, to apply to a class at first sight totally different, viz. the tailed comets, of which the great one of 1843 is so extreme an example.

Not only then does there now seem to be a chance, by pursuing the usual method of astronomical inquiry (comparing prediction with numerical observation), of ascertaining the laws of these apparently most capricious phenomena, but even of proving whether, though so diverse from every thing else in our system, they are regulated by the theory of planetary gravitation.

Erratum in the Notice for 1845, *Dec.* 12.

Page 25, line 9, *for* sin (sin $\phi - \phi^1$), *read* sin ($\phi - \phi^1$).

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